

REMARKS:

Discussion of Amendments. In making the amendments shown above, care has been taken to ensure that the claims remain supported by the specification and that no new matter has been introduced. In accordance with 37 C.F.R. § 1.121, Applicants are attaching to this response pages captioned **VERSION WITH MARKINGS TO SHOW CHANGES MADE**, containing a marked-up version of the claims thus amended, to show the changes relative to the earlier version of such. In the Amendments, Claims 4, 7 and 9 have been cancelled. Claim 8 has been amended, and new Claims 10-13 have been added. The title also has been amended in response to the examiner's objections.

I. DRAWING AND TITLE OBJECTIONS

At the time of allowance, Applicants will submit formal drawings incorporating the proposed drawing amendments that were approved by the Examiner on January 28, 2003. Applicants respectfully submit that the amendments of the claims herein obviate the outstanding rejection of the drawings under 37 CFR §1.83(a), due to deletion of reference to the third GPS unit in the claims, and that the objection to the title has been satisfied by the amendment herein.

II. REJECTION OF CLAIMS UNDER §112, FIRST PARAGRAPH

Claims 4 and 9 have been cancelled.

III. REJECTION OF CLAIMS UNDER §112, SECOND PARAGRAPH

Claims 4 and 9 have been cancelled. Claim 8 has been amended to clarify the terms objected to by the Examiner.

IV. REJECTION OF CLAIMS UNDER 35 U.S.C. § 103(A)

Applicants appreciate the time and consideration provided by Examiner in reviewing this application, but respectfully traverse the rejection under 35 U.S.C. § 103(a), and submit that the

claims as amended are not obvious over the cited references, for at least the reasons set forth below.

An object of the invention is to provide an apparatus for radiating a reference laser beam for installing a pipe so that even by a worker not skilled in measurement work, a reference laser beam can be obtained in an accurate and easily-facilitated manner.

The invention as defined in amended claim 8 comprises:

a laser beam radiator capable of rotatably radiating a laser beam;

a first GPS unit for detecting a position of said laser beam radiator to detect a reference position; and

a second GPS unit for detecting a position at which said second GPS unit is arbitrarily placed,

wherein said laser beam radiator has a receiver to receive the data on position obtained by said first GPS unit and said second GPS unit, and an arithmetic means to calculate based on the data on position received from said receiver, and said first GPS unit and second GPS unit have a radio communication unit capable of transmitting the data on respective positions of said first and second GPS units, wherein

said second GPS unit is arbitrarily placed at a first position and its position is detected by said arithmetic means so as to determine the direction of the reference laser beam to be radiated from said laser beam radiator,

said second GPS unit is then moved and placed in the direction of a laser beam radiating from said laser beam radiator as a second position, so that said arithmetic means detects the direction of the laser beam now actually radiating,

said arithmetic means calculates an angle between said first position, which is the direction of the reference laser beam radiated from said laser beam radiator, and said second position, which is the direction of the laser beam now actually radiating, and

said laser beam radiator is rotated to the direction of said second position to said first position based on the angle calculated by said arithmetic means, thereby radiating a reference

laser beam and allowing the pipe to be installed along the direction of the radiated reference laser beam.

The invention as claimed in this application differs from that of the cited references Otomo *et al* (JP Publication 11-256620, published September 21, 1999) in that an object of the system disclosed in JP'620 is for controlling a construction machine used in land-clearing activities, in which a rotational laser system, GPS, a survey machine and a control device are used to control a position of a blade attached to the construction machine, whereas the object of the instant invention is to provide an apparatus for radiating a reference laser beam for installing a pipe in such a manner that the center of the pipe coincides with the reference laser beam, so that the pipe can be accurately laid straight, without dependence upon a high worker skill level and theodolite, which is considered difficult to use even for a skilled worker.

More particularly, the system disclosed in JP '620 has a level sensor to reflect the laser beam toward a rotational laser system, and the system obtains a certain direction of the laser to the reference level position by projecting the laser from the rotational laser system to said level sensor, so that the control unit detects the laser beam reflected by the level sensor, and thereby directs the laser beam in a certain direction based on input data from the construction plan. The invention claimed in claim 8 does not rely on a target (reflector) to radiate the laser beam to the predetermined direction. The invention provides it based on the first and second GPS units, in combination with the two positions using the second GPS unit. In other words, if the level of the sensor, which acts as a reflector in JP'620, is taken away, then the system disclosed in JP '620 cannot project correctly or receive the laser beam; thus the object of JP '620 will not be attained.

On the other hand, the invention as claimed in claim 11 uses a target which acts as a reflector, but here, the target includes a diffusion surface and a pair of retroreflection surfaces as shown in Fig. 2(a). These retroreflection surfaces reflect the laser beam in the original direction, and the modulated signal detector functions to detect the pulses Q corresponding to the reflected laser beam. Then, the double pulse discriminator determines whether the pulses Q are double pulses or not, and upon detection of double pulses, the control unit drives the motor drive circuit,

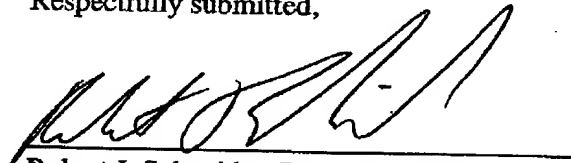
so that the horizontal angle regulation motor is driven in the opposite direction, thereby directing the laser beam toward the center of the target. The system disclosed in JP '620 fails to teach or suggests the combination of using a reflector and double pulse discriminator to project a laser beam toward the center of the target, thereby obtaining a precise laser beam in a predetermined direction, as described in this invention.

Viewing the applied prior art references, Applicants respectfully submit that it would not have been obvious to a person of ordinary skill in the art at the time the invention was made to provide an apparatus having the features set forth in the amended claims, particularly the first and second GPS units, in combination with the two positions using the second GPS to radiate and specify the reference laser beam.

The applicants respectfully submit that the claims as presented are new and not obvious, and that the rejections of the Office Action have been met. Based on the foregoing, Applicants respectfully request withdrawal of the rejection under 35 U.S.C. §103(a), and allowance of claims 8 and 10-13.

Conclusion. Applicants respectfully submit that the claims as presented define the invention in clear and concise patentable terms, and that the objections and rejections of the Office Action have been met. Applicants request favorable treatment of this application at an early date. The Commissioner is hereby authorized to charge any fees associated with this communication, including any outstanding extension fees, to our Deposit Account No. 50-0305. A return postcard is enclosed. The Examiner is encouraged to call the undersigned at the direct number (312) 845-3919 with any questions that arise in connection with this application.

Respectfully submitted,


Robert J. Schneider, Reg. No. 27,383

Dated: April 28, 2003
Attorneys for Applicant:
Robert J. Schneider
CHAPMAN AND CUTLER
111 West Monroe Street
Chicago, IL 60603-4080
Telephone (312) 845-3919

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

Please cancel claims 4 and 7, as follows:

[4. (Cancelled) An apparatus for setting a guide laser beam according to claim 9, wherein said first, second, and third GPS units are each connected to a radio communication unit for transmitting position data,

the guide laser beam radiator includes a receiver for receiving the position data and arithmetic means for calculating an angle that the radiated direction of said guide laser beam and a direction in which the guide laser beam is to be radiated make, based on the position data, and

said guide laser beam radiator directs the guide laser beam in said direction to be radiated, based on the result of the calculation by the arithmetic means.]

[7. (Cancelled) An apparatus for setting a guide laser beam according to claim 8, wherein the guide laser beam is operated to scan under control of an optical remote control unit.]

Please amend Claim 8 as follows:

8. (Amended) An apparatus for [setting] radiating a [guide] reference laser beam for installing a pipe, comprising:

a [guide] laser beam radiator [for] capable of rotatably radiating a [guide] laser beam;

a first GPS unit for detecting a position of said laser beam radiator to detect a reference position; and

a second GPS unit for [determining a direction of radiating of said radiator; and] detecting a position at which said second GPS unit is arbitrarily placed.

[a reflector provided together with said second GPS unit for reflecting said guide laser beam,]

wherein [a direction to which the guide] said laser beam radiator has a receiver to receive the data on [is to be directed and an angle in a radiated direction of the guide laser beam are obtained according to the] position [of] obtained [the radiator detected] by said first GPS unit[, a position of] and said second GPS unit, [disposed in the radiated direction of said guide laser beam, and a position of said second GPS unit disposed in the radiated direction of said guide laser beam to reflect said guide laser beam, said radiated direction of said guide laser beam being directed in said directed direction of said guide laser beam based on said obtained angle] and an arithmetic means to calculate based on the data on position received from said receiver, and said first GPS unit and second GPS unit have a radio communication unit capable of transmitting the data on respective positions of said first and second GPS units, wherein

said second GPS unit is arbitrarily placed at a first position and its position is detected by said arithmetic means so as to determine the direction of the reference laser beam to be radiated from said laser beam radiator,

said second GPS unit is then moved and placed in the direction of a laser beam radiating from said laser beam radiator as a second position, so that said arithmetic means detects the direction of the laser beam now actually radiating,

said arithmetic means calculates an angle between said first position, which is the direction of the reference laser beam radiated from said laser beam radiator, and said second position, which is the direction of the laser beam now actually radiating, and

said laser beam radiator is rotated to the direction of said second position to said first position based on the angle calculated by said arithmetic means, thereby radiating a reference laser beam and allowing the pipe to be installed along the direction of the radiated reference laser beam.

Please cancel claim 9, as follows:

[9. (Cancelled) An apparatus for setting a guide laser beam according to claim 8, wherein a third GPS unit is disposed in said direction of radiating of said guide laser beam to reflect said guide laser beam,

a direction to which the guide laser beam is to be directed and an angle in a radiated direction of the guide laser beam are obtained according to the position of the radiator detected by said first GPS unit, a position of said second GPS unit disposed in said directed direction of said guide laser beam, and a position of said third GPS disposed in the radiating direction of said guide laser beam to reflect it, and

said radiated direction of said guide laser beam is directed in said directed direction of said guide laser based on said obtained angle.]

Please add new claims 10-13 as follows:

10. (New) An apparatus for radiating a reference laser beam for installing a pipe according to claim 8, wherein said second GPS unit comprises a pole.

11. (New) An apparatus for radiating a reference laser beam for installing a pipe comprising:

a laser beam radiator capable of rotatably radiating a laser beam;

said laser beam radiator capable of directing a laser beam to the center of a target by receiving light reflected from the target;

a first GPS unit for detecting a position of said laser beam radiator to detect a reference position; and

a second GPS unit for detecting a position at which said second GPS unit is arbitrarily placed; and

a pole to which said second GPS unit and target are attached.

at least one of said first GPS unit and said pole having a radio communication unit capable of transmitting data on position, a receiver to receive the data on position, and an arithmetic means to calculate based on the data on position received from said receiver, wherein said pole is arbitrarily placed at a first position and its position is detected by said arithmetic means so as to determine the direction of reference beam to be radiated from said laser beam radiator.

said pole is then moved and placed at a second position between said reference position detected by said first GPS unit and said first position, rotating said laser beam radiator in such a manner as to radiate a laser beam to the center of said target, so that the laser beam radiated from said laser beam radiator can be directed toward the direction to which the reference laser beam is to be radiated, thereby radiating a reference laser beam and allowing the pipe to be installed along the direction of the radiated reference laser beam.

12. (New) An apparatus for radiating a reference laser beam for installing a pipe according to claim 10, wherein the pole to be placed in said first position is the same as the pole to be placed in said second position.

13. (New) An apparatus for radiating a reference laser beam for installing a pipe according to claim 11, wherein the pole to be placed in said first position is the same as the pole to be placed in said second position.